MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2022/2023 SESSION (TERM ID 2215)

PTG0116 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

13 FEBRUARY 2023
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 3 pages (excluding the cover page) with 4 questions and an appendix.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to four significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all relevant steps to obtain maximum marks.

Question 1 [25 marks]

(a) By using the conversion factor, convert
(i) 1.2π radian to degrees. [2 marks]
(ii) $32.147°$ to D° M' S''. Round your answer to the nearest seconds. [3 marks]
(iii) 10° 100' 200'' to degrees in decimals. Round your answer to two decimal places. [3 marks]

(b) Given $\sin\beta = -\frac{1}{7}$ where $\cos\beta < 0$, and $\cos\theta = \frac{1}{8}$ where $\sin\theta < 0$.
(i) Which quadrant is β in? [1 mark]
(ii) Which quadrant is θ in? [1 mark]
(iii) $A(x_1, y_1)$ is a point on the terminal side of β, and is r_1 units from the origin. Find the values of x_1, y_1, and r_1. [3 marks]
(iv) $B(x_2, y_2)$ is a point on the terminal side of θ, and is r_2 units from the origin. Find the values of x_2, y_2, and r_2. [3 marks]
(v) Find the exact value of $\sin(\beta - \theta)$ without a calculator. [3 marks]
(vi) Without using the calculator, find the exact value of $\tan 2\beta$. Rationalize your answer. [3 marks]

(c) Establish the trigonometric identity $\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x} = 2\csc 2x$. [3 marks]

Question 2 [25 marks]

(a) Given $a = -5 - 3i$ and $b = 5 + 2i$, find:
(i) $\frac{a}{b}$ in standard form $x + yi$. [3 marks]
(ii) $-3\overline{a} + 5\overline{b}$ in standard form $x + yi$. [3 marks]

(b) Given a complex number $-4 + 3i$.
(i) Convert $-4 + 3i$ to polar form. Express the argument on the interval $[0, 2\pi)$. [4 marks]
(ii) Using de Moivre's theorem, find $(-4 + 3i)^{15}$. Express your answer in both polar and rectangular forms. In polar form, express the argument on the interval $[0, 2\pi)$. [4 marks]

(c) Given $\underset{\sim}{p} = -3\underset{\sim}{i} - 4\underset{\sim}{j} + \underset{\sim}{k}$, and $\underset{\sim}{q} = 2\underset{\sim}{i} + 4\underset{\sim}{j} + 3\underset{\sim}{k}$.
(i) Find $\left|5\underset{\sim}{q} - 2\underset{\sim}{p}\right|$. [3 marks]
(ii) Find $\underset{\sim}{p} \cdot \underset{\sim}{q}$. [2 marks]
(iii) Find $\underset{\sim}{p} \times \underset{\sim}{q}$. [2 marks]
(iv) Show that $\underset{\sim}{p} \times \underset{\sim}{q}$ is orthogonal to both $\underset{\sim}{p}$ and $\underset{\sim}{q}$. [4 marks]

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Question 3 [25 marks]

(a) An ellipse is described by $x^2+4y^2-6x-16y+21=0$.

(i) Transform the equation to the standard form. [4 marks]

(ii) Find in the characteristics of the ellipse in the following table. [8 marks]

Centre	
Foci	
Vertices	
Co-vertices	
Equation of major axis	

(b) A circle is described by $x^2+y^2+2x-8y-8=0$.

(i) Transform the equation to the standard form. [2 marks]

(ii) State the radius and centre of the circle. [2 marks]

(iii) Sketch the circle. [7 marks]

(iv) Find the x-intercept of the circle. [2 marks]

Question 4 [25 marks]

(a) Find A^{-1} using cofactors if $A=\begin{bmatrix}-5 & -5 & 5\\ 1 & -1 & -2\\ -2 & 3 & -3\end{bmatrix}$. [12 marks]

(b) Write the following linear system in matrix form. Then, solve it using Cramer's rule.

$$2a+2b+c=-2$$
$$a+3b-3c=4$$
$$-4a+b-2c=-1$$

[13 marks]

Continued...

APPENDIX

$$\tan\theta = \frac{\sin\theta}{\cos\theta}$$

$$\csc\theta = \frac{1}{\sin\theta}$$

$$\sec\theta = \frac{1}{\cos\theta}$$

$$\cot\theta = \frac{1}{\tan\theta}$$

$$\sin^2\theta + \cos^2\theta = 1$$

$$\tan^2\theta + 1 = \sec^2\theta$$

$$1 + \cot^2\theta = \csc^2\theta$$

$$\sin(-\theta) = -\sin\theta$$

$$\tan(-\theta) = -\tan\theta$$

$$\cos(-\theta) = \cos\theta$$

$$\cos(A+B) = \cos A\cos B - \sin A\sin B$$

$$\cos(A-B) = \cos A\cos B + \sin A\sin B$$

$$\sin(A+B) = \sin A\cos B + \cos A\sin B$$

$$\sin(A-B) = \sin A\cos B - \cos A\sin B$$

$$\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A\tan B}$$

$$\tan(A-B) = \frac{\tan A - \tan B}{1 + \tan A\tan B}$$

$$\sin 2A = 2\sin A\cos A$$

$$\begin{aligned}\cos 2A &= \cos^2 A - \sin^2 A \\ &= 2\cos^2 A - 1 \\ &= 1 - 2\sin^2 A\end{aligned}$$

$$\tan 2A = \frac{2\tan A}{1 - \tan^2 A}$$

$$\sin^2 A = \frac{1 - \cos 2A}{2}$$

$$\cos^2 A = \frac{1 + \cos 2A}{2}$$

$$\tan^2 A = \frac{1 - \cos 2A}{1 + \cos 2A}$$

$$\begin{aligned}\tan A &= \frac{\sin 2A}{1 + \cos 2A} \\ &= \frac{1 - \cos 2A}{\sin 2A}\end{aligned}$$

$$\sin A\cos B = \frac{1}{2}\left[\sin(A-B) + \sin(A+B)\right]$$

$$\cos A\cos B = \frac{1}{2}\left[\cos(A-B) + \cos(A+B)\right]$$

$$\sin A\sin B = \frac{1}{2}\left[\cos(A-B) - \cos(A+B)\right]$$

$$\sin A + \sin B = 2\sin\frac{A+B}{2}\cos\frac{A-B}{2}$$

$$\sin A - \sin B = 2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$

$$\cos A + \cos B = 2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$$

$$\cos A - \cos B = -2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

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